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State of the environment: Report by the Executive Director

Summary

The present report summarizes the key scientific and policy issues emanating from the assessment and early-warning activities of the United Nations Environment Programme (UNEP) that need to be brought to the attention of the United Nations Environment Assembly of the United Nations Environment Programme.

The issues are drawn from the findings of various integrated and thematic assessments conducted at the global and regional levels in response to the UNEP mandate of keeping under review the world environment situation. Other scientific findings have been referenced where appropriate. In particular, the report highlights the findings of the IPCC Fifth Assessment Report.

* UNEP/EA.1/1.

State of the environment: Report by the Executive Director

I. SUGGESTED ACTION BY THE UNITED NATIONS ENVIRONMENT ASSEMBLY OF THE UNITED NATIONS ENVIRONMENT PROGRAMME

1. The Assembly may wish to consider the adoption of a resolution along the lines suggested below:

The United Nations Environment Assembly of UNEP,

Mindful of its functions and responsibilities as outlined in General Assembly resolution 2997 (XXVII) of 15 December 1972, including to keep under review the world environmental situation, and recalling the Governing Council decision GC27/11 of 22 February 2013 on the State of the environment and contribution of the United Nations Environment Programme to meeting substantive environmental challenges,

Acknowledging the General Assembly resolution 66/288 of July 2012 on the Rio+20 outcome document, *The Future We Want*, in particular its paragraph 90, calling for strengthened assessment activities and improved access to data and information, and noting the need to integrate the economic, environmental and social dimensions of sustainable development and to disseminate and share evidence-based environmental information on critical and emerging economic, environmental and social issues,

Recognizing the potential benefits of a scientifically sound and evidence-based detailed assessment of the state of the environment for awareness raising, informed policy formulation and decision-making for sustainable development,

Also recognizing that there are gaps in our knowledge of the state of the environment resulting from a lack of current data and information generation and dissemination and that there is an urgent need for Governments to take action to bridge those gaps through the building of capacities, the strengthening of existing mechanisms for environmental assessments and monitoring and the use of established comparable methods for data collection and analysis, paying particular attention to the needs of developing countries, including capacity-building and technology support,

Welcoming the release of the first three components of the *Fifth Assessment Report (AR5)* of the Intergovernmental Panel on Climate Change (IPCC), which constitute the most comprehensive and up to date assessment of the state of knowledge of climate change, its impacts, and possible response measures and an analysis of implications of climate change on sustainable development,

Welcoming also the continued support provided by UNEP to the work of the IPCC,

Noting the release of the 2013 issue of the *Emissions Gap Report*, which constitutes the most up-to-date assessment of the adequacy of the UNFCCC parties' pledges to keep the world on track to meet the 2°C target,

Welcoming the progress made during the design and development of the UNEP Live as an initiative to significantly enhance the efficiency and cost-effectiveness of the future approach to keeping the world environment situation under review, including capacity-building and technology support for developing countries and countries with economies in transition to improve their data collection and assessment efforts and ensure that data collected and information generated are made available to policy makers and the public,

Also welcoming the continued development of the Eye on Earth Alliance and Network and the implementation of the Eye on Earth special initiatives, in particular the partnerships developing through the Eye on Global Network of Networks Special Initiative as a major contribution to UNEP Live,

Further welcoming the progress made on the design and development of the Programme of Research on Climate Change Vulnerability, Impacts and Adaptation (PROVIA) as an initiative to identify research gaps and meet policy needs in respect of climate change vulnerability, impacts and adaptation,

Appreciating the outcomes of the second session of the Plenary of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), held in Antalya, Turkey from 9 to 14 December 2013,

Also noting the release of the third *Africa Environment Outlook (AEO-3)* report that reveals important linkages between health and the environment in Africa,

Further noting the release of the *Arab Region Atlas of Our Changing Environment*, which examines the environmental changes that have taken place across the Arab Region,

Invites Governments to use the IPCC AR5 findings to facilitate informed policy decision-making at all levels,

Encourages Governments, Major Groups and Stakeholders, and UN specialized agencies, funds and programmes to engage in the future development of UNEP Live and provide appropriate data and information resources to be accessed via the UNEP Live platform,

Calls upon governments in a position to do so and relevant donors to provide financial support to UNEP Live, particularly in the area of technology support, data infrastructure and capacity building so that developing countries can engage effectively in the development of UNEP Live and take advantage of the benefits that the platform will offer,

Requests the Executive Director, within the Programme of Work, to contribute to the dissemination and outreach of the IPCC AR5 and its conclusions in order to amplify diffusion among policy-makers and the public to the maximum possible extent,

Requests the Executive Director to contribute to the ongoing debate of the future work of the IPCC in view of its sixth assessment cycle, keeping in mind UNEP's role as one of the two parent organizations of the IPCC,

Requests the Executive Director to prepare a long-term plan for the development of UNEP Live through to the year 2021 with particular reference to future assessment modalities, stakeholder engagement, networking, technology support and capacity building; and present this plan to UNEA-2,

Requests the Executive Director to undertake the preparation of the sixth Global Environment Outlook (GEO-6) in accordance with the staged approach¹ and within the framework of UNEP Live,

Requests the Executive Director to report to UNEA-2 on the implementation of this decision.

II. BACKGROUND: Keeping the world environmental situation under review

1. The aim of the present report is to provide the United Nations Environment Assembly of UNEP with an overview of recent scientific assessment findings, focusing on key policy issues at the global and regional levels, in accordance with the core mandate of UNEP to keep the world environmental situation under review.

2. It should be noted that, to inform its deliberations at its first session, the United Nations Environment Assembly will have before it a number of inter-related documents on various initiatives and processes related to the aforementioned core mandate. In particular, working documents

(a) UNEP/EA.1/2/Add.1 on strengthening the science-policy interface,

(b) UNEP/EA.1/4/Add.1 on support structures and processes for keeping the world environment situation under review, including a progress report on UNEP Live,

and information documents

(a) INF/2 on the 2014 UNEP Year Book,

(b) INF/x on the Programme of Research on Climate Change Vulnerability, Impacts and Adaptation (PROVIA),

(c) INF/xx on the Eye on Earth initiative, and

(d) INF/xxx on proposed procedures to enhance future assessment processes.

The suggested action addresses issues highlighted in the above-referenced documents.

3. As the principal body for the environment in the United Nations system, UNEP has a mandate to keep the global environment and causes of environmental impacts under review.

¹ The staged approach is outlined in working document UNEP/EA.1/4/Add.1

UNEP operates at the science-policy interface by ensuring that knowledge flows to and from a global network of knowledge into policy action for the benefit of societies. This knowledge is sourced from relevant communities of practice, research institutions, and local, indigenous and traditional knowledge holders.

4. Assessments are the building blocks for keeping the world environment under review and are a means to enable policymakers to reach informed decisions. These assessments should be based on relevant, reliable and timely data and information and be peer-reviewed in a keeping with the principles of sound science. However, the temporal, thematic and spatial coverage of assessments often lacks coherency in that gaps exist in the assessment landscape in parallel with overlapping assessment processes due to assessments being conducted by various stakeholders.

5. UNEP must also respond to the challenges of poverty eradication and living within sustainable limits, emerging from accelerating global megatrends. This requires improved structural and social processes as part of a modern knowledge – based society to inform integrated goal setting and formulation of environmental policy targets across relevant spatial and temporal scales. It will build on inclusive knowledge production and management relying on broad and flexible stakeholder participation and partnerships. UNEP will use the synergies of interaction between UNEP Live, integrated assessment and GEO 6 to provide relevant user driven information on sustainable development with human well-being at the centre. As environmental change has an enormous impact on sustainable development, there is a pressing need for an integrated approach to goal setting and implementation, and environmental sustainability must be embedded in the Sustainable Development Goals (SDGs).

III. KEEPING THE WORLD ENVIRONMENTAL SITUATION UNDER REVIEW: Summary of findings of assessments conducted at the global, regional, and sub-regional levels since the twenty-seventh session of the Governing Council/Global Ministerial Environment Forum

A. Global

6. The Earth System provides the basis for all human societies and their economic activities. People need clean air to breathe, safe water to drink, healthy food to eat, energy to produce and transport goods, and natural resources that provide the raw materials for all these services. However, the activities of 7.06 billion people alive today compared to a world population of only 3.85 billion in 1972 are intensifying stresses on the Earth System beyond its capacity to absorb wastes and neutralize the adverse effects on the environment. In fact, the depletion or degradation of several key natural resources has already constrained conventional development in some parts of the world.

7. UNEP's Fifth Global Environment Outlook (GEO-5)³ and subsequent global assessments, show environmental degradation continues worldwide. Critical thresholds across the globe, including in specific localities, have been exceeded or are close to doing so. These changes have been increasingly showing serious consequences for human well-being.

Climate change

8. Climate change presents the global community with one of the most serious challenges to achieving development goals. The potential impacts from climate change are unlikely to be avoided on the basis of current emission reduction pledges. Despite attempts to develop low-carbon economies in a number of countries, atmospheric concentrations of greenhouse gases continue to increase to levels likely to push global temperatures beyond the internationally agreed limit of 2°C above the pre-industrial average temperature. In 2013-14, the Intergovernmental Panel on Climate Change (IPCC) released three components of its Fifth Assessment Report (AR5).

² See UNEP Yearbook 2013 http://www.unep.org/pdf/uyb_2013_new.pdf

³ See: http://www.unep.org/geo/pdfs/geo5/GEO5_report_full_en.pdf

9. The report of the IPCC Working Group I entitled *Climate Change 2013: the Physical Science Basis* provides a comprehensive update of the scientific understanding of the physical science basis of climate change and a firm foundation for consideration of the impacts of climate change on human and natural systems and ways to meet the climate change challenge. Key conclusions of the report are:

- (a) Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased;
- (b) Total radiative forcing is positive, and has led to an uptake of energy by the climate system. The largest contribution to total radiative forcing is caused by the increase in the atmospheric concentration of CO₂ since 1750;
- (c) Human influence on the climate system is clear. This is evident from the increasing greenhouse gas concentrations in the atmosphere, positive radiative forcing, observed warming, and understanding of the climate system;
- (d) Continued emissions of greenhouse gases will cause further warming and changes in all components of the climate system. Limiting climate change will require substantial and sustained reductions of greenhouse gas emissions.

10. IPCC's Fifth Assessment Report also showed that land and ocean surface temperature has increased globally by nearly 1°C since 1901 (0.89°C global average) mainly as a result of anthropogenic activities. However in parts of Africa, Asia, North America, and South America, surface temperatures rose by up to 2.5°C between 1901 and 2012. Urban areas have also seen heightened temperature rise, as altered storage and transfer of heat, water and airflow result in urban heat islands. Although a recent slowdown in surface warming has been observed, likely as a result of cooling of the Pacific due to strengthening of trade winds, rapid warming is expected once wind trends abate (England et al. 2014). The IPCC predicts that a global mean temperature change of +0.3 to +0.7°C is likely between 2016 and 2035 (IPCC, 2013).

START PLACEHOLDER - To be updated in May 2014

11. In 2014, two additional components of the AR5 were released, namely: the IPCC Working Group II contribution entitled *Climate Change 2014: Impacts, Adaptation and Vulnerability* in March 2014, in Yokohama, Japan; and the IPCC Working Group III contribution entitled *Climate Change 2014: Mitigation of Climate Change* in April 2014, in Berlin, Germany. The AR5 *Synthesis Report* (SYR) is to be considered in Copenhagen, Denmark, in October 2014.

END PLACEHOLDER

12. The *Emissions Gap Report*, an annual assessment of adequacy of UNFCCC party's pledges to keep the world on track to meet the 2°C target, is coordinated by UNEP and released as negotiators prepare to meet for the Conference of the Parties. The assessment is based on a host of new studies and brings new light to bear on the consequences of inaction. The *Emissions Gap Report 2013* was launched in Berlin and four other cities worldwide on 5 November 2013⁴. It was also presented to UNFCCC Parties at two side events during UNFCCC COP-19 (11-22 November 2013, Warsaw).

13. The report⁵ shows that current global emissions are around 50 gigatonnes per year of equivalent CO₂ which is substantially higher than the emissions level in 2020 consistent with a likely pathway of staying within the two degrees climate target. If all pledges are fully implemented, the emissions gap in 2020 was estimated at between 8 – 12 gigatonnes of CO₂ equivalent. The report however indicated that this "gap" can be closed by a combination of actions within the Climate Convention and by stronger national and international measures including

⁴ Beijing, Brussels, Rio de Janeiro and Washington, D.C.

⁵ The main messages, findings and response options contained in the report are available at the following link: <http://www.unep.org/publications/ebooks/emissionsgapreport2013/>

promoting sustainable agriculture practices, building bus rapid transit systems, legislating appliance standards and promoting “International Cooperative Initiatives”, for example, aimed at energy efficiency, fossil fuel subsidy reform and reduction of methane and other short-lived climate pollutants. The report also highlights the consequences of not closing the gap in 2020 which include higher cost, greater lock-in of carbon intensive infrastructure, greater risks of economic disruption and greater risk of failing to meet the two degree target.

14. UNEP’s report on nitrous oxide entitled *Drawing Down N₂O to Protect Climate and the Ozone Layer*. The initial findings of the report was presented at a side event on 24 October, 2013 at the Meeting of the Parties to the Montreal Protocol in Bangkok and the full report was launched on 21 November 2013 at UNFCCC COP-19 in Warsaw. The report, which aims at informing policymakers and stakeholders about the impacts of nitrous oxide emissions on climate and ozone layer and to present available opportunities for reducing emissions, shows that the continued build-up of N₂O in the atmosphere will make it more difficult to achieve climate targets and will to a certain extent undermine the achievements of the Montreal Protocol in restoring the ozone layer. The report however shows that N₂O emissions can be reduced by boosting nitrogen use efficiency in the agricultural sector (making the use of fertilizer, manure, and feed more efficient), installing N₂O abatement technologies in nitric and adipic acid facilities in the industrial sector, reducing biomass burning, improving fuel and combustion efficiency of household stoves, by interventions in the collection and treatment of wastewater and in aquaculture processes.

15. According to the report⁶, reducing N₂O emissions will not only produce benefits for climate and the ozone layer, but would also bring added benefits of higher agricultural productivity, lower required agricultural inputs, as well as reduced air and water pollution due to nitrogen losses to the environment.

16. On 9 May 2013, the daily mean concentration of atmospheric carbon dioxide (CO₂) surpassed 400 parts per million (ppm) – the highest recorded level since measurements began at Mauna Loa Observatory in Hawaii in 1958. Since then, seasonally corrected monthly mean concentrations of CO₂ have continued to rise.

17. Application of current low-carbon technologies and existing policy options would reduce the risks posed by climate change, but ultimately, a transformation in the way energy is produced and the efficiency with which energy and other resources are used, coupled with a shift in consumption and production patterns and investment in innovation will be required to achieve long-term climate goals.

Energy

18. Today, renewable energy production accounts for approximately 13% of the global primary energy demand. Despite an overall decline in clean energy investments for 2013⁷, total installed capacity of solar Photovoltaic increased by 43% in 2013 according to the International Energy Agency’s 2013 report⁸ and projects that the share of renewables in primary energy use will rise to 18% in 2035. The 2012 International Energy Agency reports that global bioenergy resources are more than sufficient to meet projected demand without competing with food production, however, managing land- use and biodiversity implications will require a careful planning.

Disasters

19. Since the start of the new millennium, 47 major conflicts and some 2678 disasters have affected millions of people around the world⁹. These crises have destroyed infrastructure, displaced entire populations and threatened the ecosystems that support the lives of many. The

⁶ The main messages, findings and response options contained in the report are available at the following link: <http://www.unep.org/publications/ebooks/UNEPN2Oreport/>.

⁷ See <http://www.unep.org/pdf/GTR-UNEP-FS-BNEF2.pdf>

⁸ See chapter 6 of the World Energy Outlook 2013 at <http://www.worldenergyoutlook.org/publications/weo-2013/>

⁹ See EM-DAT: The OFDA/CRED International Disaster Database at <http://www.emdat.be/database>

impacts of these crises have been disproportionately borne by the most vulnerable sectors of society, affecting livelihoods and compounding poverty.

20. Early in 2014, a number of countries have been impacted by extreme weather events. The United Kingdom and Bolivia have experienced severe flooding which has caused infrastructural damage and displacement of people. Heavy snowstorms and unusually low temperatures have hit the USA and Japan with cold fronts reaching much lower latitudes.

Ecosystems

21. The current trends in the state of our ecosystems are undermining our ability to tackle poverty, improve the health, prosperity and security of our populations, and deal with climate change, and each of these will be greatly strengthened if we correctly value the role of biodiversity in supporting the shared priorities of the international community. We can no longer see the continued loss of and changes to biodiversity as an issue separate from the core concerns of society. Substantial loss of biodiversity and the degradation and over-exploitation of habitats has already affected the provision of ecosystem functions and services, such as water regulation and the collapse of a number of fisheries. According to the *Fifth Global Environment Outlook (GEO-5)* the number of eutrophic coastal areas has increased dramatically since 1990 – at least 415 coastal areas have exhibited serious eutrophication and only 13 of these are recovering.

22. The current trends in economic development are based on unsustainable linear economic growth, which has come at the expense of equity, natural resources and ecosystems. Many terrestrial ecosystems are being severely degraded because of the lack of proper long-term policies that address land use decisions. Measures fail to recognize noneconomic ecosystem functions that limit productivity and long-term ecosystem sustainability. For example, short-term financial pressures have encouraged the irrigation and subsequent salinization of vast dryland areas, making them very costly to rehabilitate for the present and future populations. Deforestation and forest degradation produce financially attractive short-term profits, but estimates based on alternative accounting methods by *The Economics of Ecosystems and Biodiversity* work suggest that they are costing the global economy between US\$2.0 and US\$4.5 trillion a year¹⁰ – more than the losses of the 2008 economic crisis.

Forests

23. While the rate of forest loss is slowing, it remains alarmingly high with annual forest lost, between 2000 and 2010, at approximately 13 million hectares¹¹. A recent global mapping of forest cover¹² reports a loss of 2.3 million square kilometres and gain of only 0.8 million square kilometres from 2000 to 2012, with the tropics experiencing the greatest total loss of 2101 square kilometres per year. Heightened interest in carbon sequestration has inspired new incentives and financing for ecosystem protection. One such opportunity – Reducing Emissions from Deforestation and forest Degradation in developing countries, or REDD – has emerged as an important component of a global strategy to reduce emissions while generating financial flows from North to South.

Food Security and Land

24. Food insecurity and land degradation will intensify unless increasing pressures and competing demands on land are wisely managed. Meeting this challenge will require the adoption of new economic paradigms that explicitly factor in the environment. Options towards a Green Economy¹³ is one such approach, which includes the principles: valuation of natural resources and environmental assets; pricing policies and regulatory mechanisms that translate

¹⁰ For example see http://www.unep.org/pdf/OP_sept/2010/EN/OP-2010-09-EN-FULLVERSION.pdf

¹¹ See <http://www.fao.org/docrep/013/i1757e/i1757e.pdf>

¹² See <http://www.sciencemag.org/content/342/6160/850>

¹³ See UNEP's Green Economy initiatives at <http://www.unep.org/greeneconomy/>

these values into market and non-market incentives; and measures of economic welfare growth that are responsive to use, degradation, and loss of ecosystem goods and services. The 2013 publication entitled *Smallholders, Food Security and the Environment*¹⁴ reports that supporting smallholder farmers to play a greater role in food production and natural resource stewardship is one of the quickest ways to lift over one billion people out of poverty and sustainably nourish a growing world population.

25. The 2014 report of the International Resource Panel entitled *Assessing Global Land Use: Balancing Consumption with Sustainable Supply*¹⁵ highlights that up to 849 million hectares of natural land – nearly the size of Brazil – may be degraded by 2050 should current trends of unsustainable land use continue. However, up to 319 million hectares of land can be saved by 2050, if the world follows a combination of measures designed to keep cropland expansion within the ‘safe operating space’ that include improving land management and land use planning in order to minimize the expansion of build-up land on fertile soils, improving agricultural production practices to increase intensification in an ecologically and socially acceptable way, improving efficiency along the whole food chain by increasing crop yields through research and extension, and reducing food waste and spoilage by improving transport, storage and distribution infrastructure in developing countries, and changing behaviour in wealthier societies where much food waste occurs and shift towards more vegetable diets will also be crucial to improving food security. It will be necessary to reduce the subsidization of fuel crops – including the reduction and phase out of biofuel quotas in consuming countries.

26. The report also explores how the management of land-based biomass production and consumption can be developed towards a higher degree of sustainability across different scales: from the sustainable management of soils on the field to the sustainable management of global land use as a whole. A central question posed by the authors is to what extent global cropland can expand to serve the growing demand for food and non-food biomass, while keeping the consequences of land use change, such as losses of biodiversity, at a tolerable level. Over the last five decades, the area used for agriculture has been expanding at the expense of forests, in particular in tropical regions. On average, 13 million hectares per year have been deforested, with also significant impacts on biodiversity. Around 23% of global soils are estimated to have been degraded. The current trends of cropland expansion, land degradation, yield stagnation, nutrient pollution and large-scale land acquisition show the urgent need to improve the management of land resources. Measures to improve productivity will not be enough to maintain sustainable levels of land use in the future but the combination of consumption-oriented measures with improved land management and restoration of degraded land, may allow us to save 161 to 319 million hectares of land by 2050.

Freshwater

27. Up to 90% of wastewater in developing countries flow untreated into rivers, lakes and highly productive coastal zones, threatening health, food security and access to safe drinking and bathing water¹⁶. The cumulative impacts of excessive, illegal or unregulated wastewater discharges particularly affect coastal areas, since these contain some of the world’s most productive yet fragile ecosystems. The pace of increasing demands on freshwater and ocean resources must be matched by improved governance. The open oceans are a major global commons and require effective international cooperation and governance. Most human and environmental water problems result from inadequate governance involving policy, institutional, financial and/or stakeholder issues. Integrated management approaches for addressing these constraints require time and resources to be successful. They need enhanced integration of policies and institutions between sectors and governance levels, implementation and enforcement of relevant agreements and goals, improved monitoring and resolution of transboundary issues. Good governance, including stakeholder and private sector participation and gender considerations, is critical to increasing societal and environmental resilience and sustainability.

¹⁴ See <http://www.unep.org/greeneconomy/>

¹⁵ See [http://www.unep.org/resourcepanel/Portals/24102/PDFs/Full_Report-Assessing_Global_Land_UseEnglish_\(PDF\).pdf](http://www.unep.org/resourcepanel/Portals/24102/PDFs/Full_Report-Assessing_Global_Land_UseEnglish_(PDF).pdf)

¹⁶ See http://www.unep.org/pdf/SickWater_screen.pdf

Coastal and Marine

28. The many challenges facing coral reefs were highlighted in the 2012 UNEP Foresight Process on Emerging Environmental Issues for the 21st Century. A fifth of the world's coral reefs have been lost, and more than 60 percent are under immediate and direct threat from over harvesting, pollution arising from land-based activities including nutrients, sediments, and sewage, and physical alteration and destruction of habitat as a result of poorly managed coastal development¹⁷. Invasive alien species constitute a further nefarious threat, as illustrated by the introduction of Indo-Pacific lionfish to the Caribbean¹⁸. This undermines the integrity and service provision of coral reefs and threatens food security, the health and wellbeing of coastal people, and the economies of many countries. It also reduces the ability to withstand and adapt to increasing climate change. Repeated coral bleaching (a stress response caused by above-average sea surface temperatures that can lead to mortality) has been recorded in most regions since the mass mortality in 1998. While strong recovery has been seen in some areas where direct stress is low¹⁷, recovery is stalled or weak where there are substantial human pressures. Evidence is also beginning to emerge of coral sensitivity to ocean acidification, with decline in coral calcification rates and potentially significant ecological and economic implications. Recent detailed analysis of long term coral reef data in the Caribbean¹⁹ shows that, while Caribbean live coral cover overall has seen drastic decline in the past 40 years, there is enormous variability among reef locations. Coral abundance today is strongly correlated with the history of overfishing and abundance of the sea urchin *Diadema antillarum* prior to mass mortality in 1983-84, whereas correlation with incidence of hurricanes or outbreaks of coral bleaching and disease is less strong. This provides further evidence that ecosystem management has a significant impact on condition of coral reefs also during climate change. Ensuring continued provision of coral reef ecosystem services requires ecosystem-based management that addresses multiple threats in an integrated manner and builds resilience in the face of climate change, including through enhanced policy application of assessments of coral reef status and trends as well as ecosystem service values.

29. The largest ever under-ice algal bloom was recorded in the Arctic in 2012 (NASA - ICESCAPE). Since then many other related phenomena have been observed²⁰. The key driver of under-ice algal blooms is thought to be the climate change via its impact on thinning of sea ice and surface meltwater which allow higher light penetration into under ice waters leading to much greater phytoplankton densities than expected. Changes in river discharge patterns and the concentration of nutrients entering Arctic waters from land are also likely to reinforce this phenomenon in future especially in coastal areas. Although the effects of algal blooms on Arctic ecosystems are yet to be studied in detail, food chains involving migratory species of mammals, birds and fish as well as species affected by oxygen conditions on the sea bottom are likely to change. Decreases in sea ice extent as well as thickness is thought to be a driver of marine and terrestrial ecological dynamics, influencing productivity, species interactions, population mixing, gene flow, and pathogen and disease transmission.

30. UNEP, as part of its function as Secretariat for the Global Partnership on Marine Litter, has been paying attention to the emerging issue of micro-plastics. Plastic debris may enter the ocean directly, or it may find its way there via other water bodies or the atmosphere. The key to stemming flows of plastic debris to the ocean is to prevent this debris entering the environment. Based on the limited data available, there appears to have been a significant increase in concentrations of microplastics in surface waters of the ocean during the past four

¹⁷ Wilkinson 2008: Status of Coral Reefs of the World 2008. http://gcrmn.org/?post_type=gcrmn-publication&p=153; Burke et al 2011: Reefs at Risk Revisited. <http://www.wri.org/publication/reefs-risk-revisited>

¹⁸ Gómez Lozano et al 2012: Regional Strategy for the Control of Invasive Lionfish in the Wider Caribbean. http://www.icriforum.org/icri-documents/icri-publications-reports-and-posters/lionfish_strategy

¹⁹ Jackson et al (in press): Status and Trends of Caribbean Coral Reefs 1969-2012. GCRMN, IUCN, ICRI, UNEP. <http://gcrmn.org/gcrmn-publication/tropical-americas-coral-reef-resilience-workshop-2012/>

²⁰ See latest knowledge: Massive phytoplankton blooms under Arctic sea ice (DOI: 10.1126/science.1215065 Arrigo et al 2012); Ecological consequences of sea-ice decline (DOI: 10.1126/science.1235225 Post et al 2013); Export of algal biomass from the melting Arctic sea ice (DOI: 10.1126/science.1231346 Boetius et al 2013)

decades. A large number of plastic materials are currently being applied in personal care and cosmetic products (PCCPs) for a variety of purposes. They tend not to be filtered out during sewage treatment, but to be released directly to the ocean or other water bodies such as lakes and rivers.

31. Globally, recent scientific meta-analyses on carbon sequestration and storage in coastal ecosystems have estimated that carbon dioxide emissions from the degradation and clearing of coastal ecosystems are significant. Approximately 0.15 – 1.02 Pg (billion tons) of carbon dioxide are being released annually, equivalent to 3 – 19% of those from deforestation globally, and resultant in economic damages of 6 – 42 billion US\$ annually.²¹

Chemicals

32. The way the world manages chemicals will play a key role in the transition towards an inclusive Green Economy and the realization of a sustainable twenty-first century. The *2013 Global Chemicals Outlook*²² highlights that increasingly production and consumption of chemicals is now taking place in developing countries and countries with economies in transition. Detailed data on waste are lacking due to the absence of pollution release and transfer registries in developing and transition countries. The increasing production, use and disposal of chemicals have significant implications for the environment and human health. Effects on ecosystem resources include contamination of air, water, and soil, with adverse impacts on food sources and wildlife as well as human health effects. In this context, it is necessary to consider policy approaches to ensure that chemicals are produced and used in ways that minimize impacts on health and the environment. The failure to adopt sound chemicals management can impose large economic costs and conversely, sound chemicals management can yield significant economic benefits in terms of economic development, poverty reduction and, crucially, reduced human health and environmental risks.

33. Effective management of these issues can be achieved by further promoting synergies among Multilateral Environmental Agreements (MEAs) in terms of administrative, logistical and programmes integration; strengthening international and national chemical control activities including legislation to address gaps in current chemicals related MEAs; mainstreaming sound chemicals management into multilateral and bilateral economic assistance programmes; and by fostering public private partnerships to promote the implementation of sound chemical management policies and strategies as a contribution to economic development plans and processes.

Resource Efficiency

34. The global use of natural resource materials increased by over 40% between 1992 and 2005, from about 42 to nearly 60 thousand million tonnes²³. On a per capita basis, the increase was 27%. Among the four major material groups (biomass, fossil fuels, ores and industrial minerals, and construction minerals) there has been a major increase in extraction of construction minerals of almost 80%, followed by ores and industrial minerals (close to 60%). The global primary production of metals shows a large share of the world's energy use of between 7 and 8 per cent of the total global energy use and causes severe local environmental impacts. A continued global rise in metals demand is currently predicted for the decades ahead due to urbanization and the build-up of infrastructure in developing countries that will further increase the environmental impacts of metal production²⁴. What economies worldwide need is absolute decoupling of the environmental pressure associated with resource consumption from economic growth. This will be easier to achieve to the extent that resource use itself becomes more efficient.

Nutrients

²¹ Citation: Pendleton L, Donato DC, Murray BC, Crooks S, Jenkins WA, et al. (2012)

²² See <http://www.unep.org/chemicalsandwaste/>

²³ http://www.unep.org/geo/pdfs/keeping_track.pdf

²⁴ See 2013IRP report <http://www.unep.org/resourcepanel/Publications/EnvironmentalChallengesMetals/tabid/106142/Default.aspx>

35. In 2013, the Global Partnership on Nutrient Management (GPNM), released a Global Overview on Nutrient Management entitled *Our Nutrient World – The challenge to produce more food and energy with less pollution*²⁵. The Overview highlighted how humans had massively altered the natural flows of nitrogen, phosphorus and other nutrients and caused a web of water and air pollution that is damaging human health, causing toxic algal blooms, killing fish, threatening sensitive ecosystems and contributing to climate change. Since the 1960s, human use of synthetic N fertilizers has increased 9-fold globally, while P use has tripled. Further substantial increase of around 40-50% is expected over the next 40 years in order to feed the growing world population and because of current trends in dietary lifestyles, with increasing consumption of animal products. These changes will exacerbate current environmental problems unless urgent action is taken to improve the efficiency of N and P use, and to re-evaluate societal ambitions for future per capita consumption patterns.

36. The efficiency of nutrient use is very low. On average over 80% of N and 25-75% of P consumed end up lost to the environment, wasting the energy used to prepare them, and causing pollution through emissions of the greenhouse gas nitrous oxide (N₂O) and ammonia (NH₃) to the atmosphere, plus losses of nitrate (NO₃⁻), phosphate (PO₄³⁻) and organic N and P compounds to water. A 20% improvement in nutrient use efficiency by 2020 would reduce the annual use of nitrogen fertilizer by 20 million tonnes, which could provide a net saving worth around 110 billion pounds Sterling per year.

37. There is an urgent need to develop joined-up approaches that optimize the planet's nutrient cycles for delivery of our food and energy needs, while reducing threats to social and economic wellbeing, including threats to climate, ecosystem services and human health. This set of multiple connections may be termed 'The Nutrient Nexus', where good nutrient management can be seen as making a vital contribution to all global change challenges. The consequences of not taking action include further global warming effects from increasing atmospheric N₂O (a greenhouse gas which is 300 times more radioactively reactive than CO₂), continuing deterioration of water, air and soil quality, shortening human life, while threatening ecosystem services and biodiversity. The full damage cost has not yet been assessed, but annual global loss of ecosystem services including damage to fisheries from coastal N and P pollution-related hypoxia alone costs an estimated \$170 billion. Making better use of nutrients will reduce these pollution threats, while improving food and energy production.

B. Regional

38. Assessments conducted at the regional level are usually carried out in response to mandates from regional fora such as the Africa Ministerial Forum on the Environment (AMCEN) or the Council of Arab Ministers Responsible for the Environment (CAMRE). In addition to addressing regional issues, the findings of such assessments also support global assessment processes. The assessment cycle for regional assessments can vary from 3 years (Africa) to 5 years (Europe). However, some regional and sub-regional assessments are done on a 'once off' basis.

Africa

39. The third *Africa Environment Outlook (AEO-3)* report²⁶ was launched on 17 October 2013 during the fifth Special Session of the African Ministerial Conference on the Environment (AMCEN). The report reveals that 28 per cent of Africa's disease burden is directly related to the decline in environmental integrity. Diarrhoea, respiratory infections, and malaria account for 60 per cent of known environmentally-related diseases in the region. The AEO-3 uses the latest data available on air quality, biodiversity, chemicals and waste, climate change,

²⁵ <http://www.gpa.unep.org/index.php/global-partnership-on-nutrient-management/publications-and-resources/global-partnership-on-nutrient-management-gpnm/143-our-nutrient-world>

²⁶ The main messages, findings and response options contained in the report are available at the following link: <http://www.unep.org/pdf/aeo3.pdf>.

freshwater and sanitation and land while emphasizing the need to update existing data on linkages between health and the environment in Africa.

40. *The Adaptation to Climate Change Induced Stress in the Nile Basin: A Vulnerability Assessment Report*²⁷ was launched on 4 September 2013 in Stockholm, Sweden, during the World Water Week. Climate change-induced water stress is a growing concern in the Nile Basin, which provides vital resources to 238 million people in 11 countries, but risks can be reduced through building adaptation strategies into development policy, boosting transboundary cooperation and improving available data on future water availability.

Asia and the Pacific

41. The report entitled *Recent Trends in Material Flows and Resource Productivity in Asia and the Pacific*²⁸ was released on 24 April 2013 at the Asian and Pacific Regional Implementation Meeting (RIM) on Rio + 20 Outcomes, as a special contribution to the regional deliberations of its follow up actions to Rio+20. The report covers the period including the onset of the global financial crisis, and concludes that Asia Pacific has surpassed the rest of the world in its consumption of materials and will continue to dominate world material flows. The region's trade balance indicates that the current rate of exploitation of its resource base is no longer sufficient to support the region's fast-growing economies and changing lifestyles. From 1970-2008, consumption of construction minerals increased 13.4 times, metal ores and industrial minerals consumption 8.6, fossil fuels 5.4, and biomass 2.7 times. The data indicates that, at this rate, the region will be increasingly dependent on imports and unable to sustain its economies and lifestyles. The report underlines that Asia and the Pacific still has enormous opportunities to make the transition of current economic growth patterns towards green growth, and to transform the economies into truly green economy, despite the greater challenges faced by member countries.

42. Under the auspices of the South Asian Association for Regional Cooperation (SAARC), UNEP collaborated with regional institutions and member countries to develop South Asia Environment Outlook 2013/14. The South Asia sub-region encompasses 8 countries: Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. The report intends to analyze environmental challenges and priorities in the context of human development and economic growth issues at both regional and national levels. It will also review the interlinkages between environmental priorities, such as climate change, land degradation, air and water pollution and loss of biodiversity, and the drivers of environmental changes like urbanization, economic growth and unsustainable consumption. Various policy and institutional options to cater to the emerging challenges of the sub region will be developed.

Europe

43. The *Resource Efficiency: Economics and Outlook for Eastern Europe, the Caucasus and Central Asia (REEO for EECCA)*, one of a series of UNEP studies, following a similar analytic methodology, to be released in 2014, will provide a greater understanding of what underlies resource efficiency issues in this large and rapidly evolving region of the world. The report will provide an in-depth analysis of material flows and resource efficiency at both the country and regional level; a close-up examination of water use and efficiency in the region; and finally, an analysis of policies relating to natural resource management and use across the region.

Latin America and the Caribbean

44. The *Recent Trends in Material Flows and Resource Productivity for Latin America*²⁹, published by UNEP and the Commonwealth Scientific, Industrial and Research Organization (CSIRO), uses standardized material flow accounting methodologies to construct empirical

²⁷ The main messages, findings and response options contained in the report are available at the following link: http://www.unep.org/dewa/Portals/67/pdf/Nile_Basin.pdf

²⁸ [http://www.unep.org/pdf/RecentTrendsAP\(FinalFeb2013\).pdf](http://www.unep.org/pdf/RecentTrendsAP(FinalFeb2013).pdf)

²⁹ Available at: <http://www.pnuma.org/english/comunicados/2013/20130619/index.php>

evidence of resource productivity in 10 focus countries in Latin America. The report is based on the database of material flows created to cover larger countries of Latin America and the Caribbean³⁰. Among other findings, the report provides evidence that resource efficiency (as measured by raw materials extracted per unit of GDP) declined from 1970 in the region, largely because of a massive increase in extractive industries, much destined for export.

West Asia

45. The *Arab Region Atlas of Our Changing Environment*³¹ was launched in Abu Dhabi on 10 December 2013. The *Atlas* examines the environmental changes that have taken place at more than 80 locations across the Arab Region, using a combination of on-the-ground photographs, current and historical satellite images, with a narrative based on extensive scientific evidence. "Before-and-after" studies in the atlas clearly demonstrate the pace of development in the region, offering compelling examples of wide-ranging environmental change, including land use change, urban growth, degradation of marine and coastal areas, altered hydrology and shrinking water bodies, loss of habitats and impacts of climate change.

46. The *Arab Millennium Ecosystem Assessment Synthesis Report* was launched on 7 November 2013 in Cairo. The report represents a synthesis of the findings of the three Arab Millennium Ecosystem Sub-Global Assessments and highlights the commonalities and differences between the sites and how they relate to the national, regional and global ecosystem. The report indicates that ecosystems in the Arab region are subject to rapid depletion, posing a significant challenge to sustain future generations. The common ecosystem services in the three assessments include water, agriculture, grazing and raising cattle, aromatic and medicinal plants, and biodiversity. Achieving sustainable management of ecosystems requires a number of interventions including sustainable use of ecosystems, empowering human capital and providing leadership, institutional reform, and innovation through knowledge sharing, reshaping traditional approaches, progressive environmental governance, creative solutions, and sharing of best practices.

47. The Vulnerability Assessment of Freshwater Resources to Climate Change: Implications for Shared Water Resources in the West Asia Region³², an assessment report prepared in cooperation with Arabian Gulf University, ACSAD, and CEDARE. The assessment provides a better understanding of freshwater resources vulnerability to threats and its impacts on development options, human well-being and the environment. It identifies the potential impacts of climate change on water resources in the region and assesses the current adaptive capacity of the water sector. It also provides decision-makers with strategic responses and policy options to improve water resource management including adaptation measures. Water stress in West Asia is expected to deepen due to the impacts of climate change and will remain a major constraint to socio-economic development. Understanding the vulnerability of water systems in West Asia, therefore, is vital for sustainable water resource management in the region. The assessment concludes that political action is needed to ensure sustainable management of water resources, with vulnerability and adaptation to climate change integrated into future national plans. It recommends that resource management policies shift to demand management, water use efficiency and conservation.

48. A comprehensive scientific assessment of coastal ecosystem carbon and ecosystem services values in Abu Dhabi was carried out under the Eye on Earth Special Initiative on Oceans and Blue Carbon. This was the first time this type of assessment has been carried out in the region, and the scientific findings show that Abu Dhabi's coastal ecosystems store significant amounts of carbon that would be emitted if they are degraded. Carbon stocks in coastal ecosystems are the largest of any ecosystem in the Emirate, although on a global scale they are on the low end of the spectrum. Wider ecosystem services, including shoreline buffering, erosion control, water quality maintenance, support to fisheries, tourism and

³⁰ Available at: <http://www.ces.csiro.au/forms/form-mf-la-start.aspx>

³¹ <http://na.unep.net/atlas/viewAtlasBookWithID.php?atlasID=2447>

³² http://www.unep.org/dewa/Portals/67/pdf/Freshwater_vulnerability_Report_HR.pdf

recreation were found to be more valuable at local scales than carbon, with cultural values attached to mangroves being especially high.³³

IV. EARLY WARNING OF ENVIRONMENTAL THREATS AND EMERGING ISSUES

49. UNEP's Global Environmental Alert Service (GEAS) focuses on identifying and communicating emerging environmental issues to raise public awareness. GEAS takes the pulse of the planet and enhances UNEP's ability to provide regular, science based updates to its member states, allowing them to make informed policy choices against expected adverse impacts on the well-being of people and on the services that different ecosystems provide. It continuously scans the scientific literature, analyses results of earth observations and other data sources to produce easily understandable alerts, focusing on policy relevant environmental hotspots, environmental science, and near real-time environmental hazards. GEAS communicates the emerging scientific findings in an appropriate and accessible way to policy-makers, the international community, humanitarian groups, civil society, and media on the status and trends of the global environment.

50. UNEP has experienced a significant global readership of GEAS as demonstrated by increasing web visits and download statistics³⁴. Circulated every month to a list of over 500,000 users globally, GEAS bulletins include new visual evidence of global environmental change resulting from natural processes and human activities and the interaction between them. The "change studies" are described and analyzed through photographs, satellite images, maps and narratives that provide insight into the many ways and places the environment has changed and continues to be modified. GEAS has been referenced in scientific journal articles and newspapers and is regularly published in the journal *Environmental Development*.

51. UNEP will provide the global community with access to dynamic and compelling, easy to understand, policy-relevant information about environmental changes as they occur with the goal of mitigating environmental harm through ebooks and near real time data and information updates.

52. Emerging environment issues have been brought to the attention of decision makers on a regular basis through the *UNEP Year Book series: emerging issues in our global environment*. A decade ago, UNEP started the Year Book series by focusing on the issue of excess nitrogen and dead zones in the 2003 report. Today, following the publication of the 10th edition, the *UNEP Year Book 2014*³⁵ takes the form of a special anniversary edition, revisiting key emerging environmental issues that were highlighted in the series in the past decade. These include topics such as excess nitrogen, emerging infectious diseases, plastic debris in the ocean, and rapid change in the Arctic. For each topic, a succinct synopsis of the situation is provided, followed by an overview of new scientific evidence and key developments since the issue was published by UNEP. Examples of successful efforts by stakeholders are given, directly highlighting the work of partners, and options for actions are presented for consideration by decision makers. To embrace opportunities provided by new technology as well as the launch of UNEP Live to reach wide audiences, the UNEP Year Book 2014 is prepared as an eBook and from the web, and includes videos explaining the issues, interactive graphs showing trends, interviews with experts and live links to data sources, articles and relevant knowledge providers. The overall findings show that in many cases, the issues from the past still persist today despite better scientific understanding and a multitude of actions undertaken by various stakeholders to address the issues.

V. Conclusion

53. As the world sets the building blocks for a post-2015 sustainable development agenda, there is abundant evidence that Earth's Systems are changing; moving us closer to alarming

³³ See <http://grida.no/publications/abu-dhabi-blue-carbon/>

³⁴ Titles of recent bulletins and response actions may be found at <http://na.unep.net/geas/index.php>.

thresholds. Environmental degradation and widespread changes resulting from human activity as well as natural processes and the loss of ecosystem services are barriers to the attainment of internationally agreed development goals.

54. Science and science communities are being asked to continuously synthesize the latest state of environmental system information to address a growing set of key environmental challenges facing society at large on global to local scales arising from a changing Earth system. UNEP's knowledge now needs to be processed from a variety of disciplines, covering data and information on a broad geographical and temporal scale. Now the goal is to use this knowledge in a dynamic, multidirectional, science socio-economic policy process, to inform people about the risks, opportunities and choices that exist, rather than to advocate for a particular management solution.